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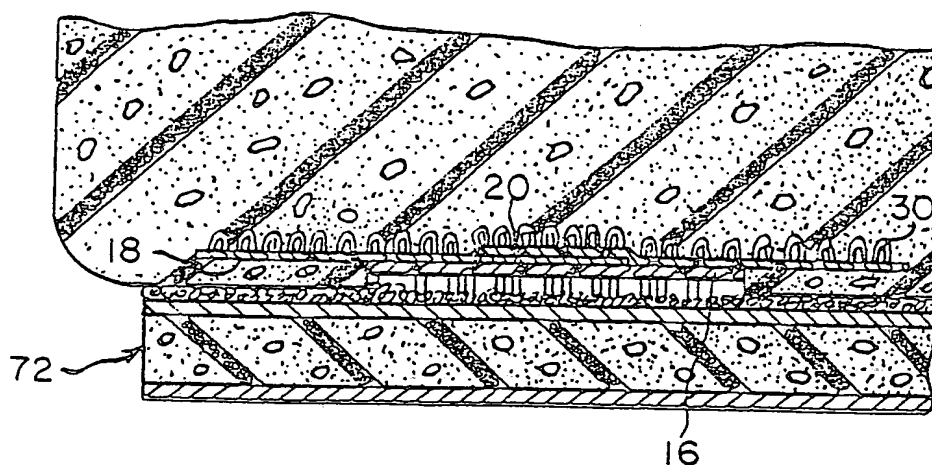
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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: **METHOD AND APPARATUS FOR ADAPTING SEPARABLE FASTENERS FOR ATTACHMENT TO OTHER OBJECTS**



## (57) Abstract

An adapted separable fastener and method of making the same for attachment to other objects such as seat cushions. A separable fastener member (16) of the hook and loop-type is attached, in back-to-back relation, to a substrate (18). The substrate member may either be of an absorbent type, or it may have a plurality of upstanding elements (30) which are ultimately surrounded and encapsulated by foam formed during polymerization. The adapted fastener is thereby attached to a foam member. The elements (30) are positioned in order to allow venting of the gaseous by-product of polymerization. A metallic strip (20) is interposed between the separable fastener member (16) and the substrate member (18) which allows the fastener member (16) to be magnetically held in the mold during the forming of foam objects to facilitate simultaneous forming of the object and attachment of the separable fastener member (16). An apparatus for ultrasonically attaching the separable fastener and the substrate is also disclosed.

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METHOD AND APPARATUS FOR ADAPTING  
SEPARABLE FASTENERS FOR  
ATTACHMENT TO OTHER OBJECTS

BACKGROUND OF THE INVENTION

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1. Field of the Invention

This invention relates to an apparatus and method for adapting separable fasteners of the hook and loop-type for attachment to other objects, particularly such objects as polyurethane foam seat cushions for automobiles, furniture or the like. The resultant unique adapted fastener, which is manufactured on the apparatus of the invention, simplifies attachment of objects to other objects or members, as well as attachment of other objects or members to the main object.

2. Description of the Prior Art

Hook and loop fasteners are well known and are used to join two parts detachably to each other. These fastener strips consist of mating fastener tapes having hooks and loops respectively on either tape, which on being pressed together will interlock and so form a connection. Such fastener strips are employed where ease of connection and disconnection is desired or where an infinite adjustability within a circumscribed range is desired.

Although originally having their primary use in wearing apparel, separable fasteners have expanded significantly in use. However, the areas of expansion have been limited by some of the properties of such separable fasteners as now produced. For example, attaching the fasteners to other items has sometimes been difficult which difficulty may limit their use. A known method of attaching

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these fasteners to a multitude of members has been to stitch the fasteners to the item. Such stitching procedure however is sometimes laborious, and is not always available for attachment to bulky items. In particular wider strips are advantageous for attachment to objects having surface delamination problems. Bonding or adhesively securing the fastener to other items requires pressing the areas to be joined together for substantial lengths of time to permit curing of the bonding agent. In addition, when pressing the active areas of the fasteners against the substrate member the hooks and/or loops of the fastener strips are sometimes so deformed and crushed that the tapes no longer function satisfactorily and the repeated fastening is no longer assured. Further, adhesive attachment requires adhesive compatibility between the fastener, the adhesive and between the adhesive and the object to which it will be attached.

For attachment of the fasteners to other objects such as polyurethane foam seat cushions for automobiles or the like, fastening of the tapes has been difficult due to the lack of suitable adhesives or fastening techniques. In fact, in the case of seat cushions, such fasteners would make it possible to separably attach seat covers or the like. Further, attachment of the fasteners to other known objects would facilitate attachment and detachment of known functioning items or appurtenances which would not otherwise be possible.

We have invented a method and apparatus for adapting such separable fasteners for attachment to known objects either by known adhesives or by attachment to plastic foam objects during the actual molding or other formation process of the objects, while avoiding the disadvantages of the prior art.

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SUMMARY OF THE INVENTION

This invention relates to a method and apparatus for adapting a separable fastener. More specifically it relates to adapting a separable fastener of the hook and loop-type by ultrasonically attaching a substrate to it. By attaching a substrate member to the side of the separable fastener opposite the side having a plurality of engaging elements upstanding from the surface, the fastener is adapted for easy fastening using more conventional means than presently in use. In one embodiment the substrate member is in the form of a base member having a plurality of monofilament loop elements upstanding from one surface. In another embodiment the substrate member is a liquid absorbant material.

The adapted fastener may be attached to a variety of objects. The fastener may be attached to polyurethane foam objects for automobile seats, furniture seats, etc. using a variety of attachment techniques. For example the fastener may be attached by using adhesives. The adhesive can be polyurethane, adhesive cement, epoxy, hydraulic cement synthetic rubber based adhesives such as nitrile rubber base adhesive or almost any known adhesive. The separable fastener tape itself may be either woven, molded, knitted or non-woven and may be made of any of the substances used to make the tape such as nylon or polyester.

One of the unique features of the adapted fastener is its compatability with attaching techniques using polyurethane. The polyurethane may be used as many other adhesives are used by positioning it between the fastener substrate and the object and then allowing the polyurethane to cure. A second method of attachment using polyurethane is performed by using the polyurethane to form a section of the

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object while simultaneously providing the adhesive bond. To accomplish this objective, a trough or groove is either formed or cut into the object. The fastener is then placed into position and polyurethane is used to fill the trough or  
5 form a part of the object to which the fastener is to be attached. When the polyurethane sets it provides the bond for the fastener.

A third and preferred method of using polyurethane  
10 is to actually attach the adapted fastener into a polyurethane object during the formation of the object. This is accomplished by using a mold with a special trough or section for holding the adapted fastener and protecting its elements during the forming process. The mold is then filled  
15 with forming components that undergo polymerization and fill and surround the substrate either by an absorption process or a soaking process, depending upon the substrate material. When the molding operation is complete, a polyurethane object is formed having a separable fastener member integrally  
20 molded to it. Othersynthetic resins such as polystyrene or polyvinyl chloride may also be used in place of polyurethane.

The method of the invention is particularly useful in the formation of seat cushions for use in furniture or  
25 automobiles. After the fastener is attached or molded to the object, a cover may then be attached either by use of a corresponding surface of mating elements or by the plurality of filaments that are present in many fabric or foam backed covers. In this manner a seat cushion with an easily  
30 attached cover is produced. These same methods may be used to attach other objects to the object with the adapted fastener attached.

The apparatus of the invention is made up of a  
35 series of subcomponents positioned at sequential stations.

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Each station performs operations that may be added or eliminated, depending upon the desired form and properties of the final desired adapted fastener product. Initially the apparatus should have at least one ultrasonic attaching station. Means are provided for movably supporting the fastener tape and substrate while holding them in the proper relative positions. The tape and substrate then pass through a station with means for continuously ultrasonically attaching the fastener to the substrate.

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The ultrasonic attachment is performed by ultrasonic stitching. The ultrasonic stitching machine produces a continuous series of interrupted "melt" or "weld" spots along the length of the tape and substrate.

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It may be desired to cut the tape to predetermined lengths and to provide finished ends at the cut. This is accomplished by using a second ultrasonic station which crushes, melts and welds a small portion of the fastener elements. This is done at predetermined locations along the tape length. The resultant flat area provides a mark to provide physical indication as to where the tape is to be cut, while at the same time providing finished ends for the portions thus cut.

25

It is desired in some applications to provide an adhesive layer to either the margins of the substrate, or to the back of the substrate, or both. For example the adhesive layer may be placed on the margin in order to hold the fastener in a mold-in operation. This adhesive may also be used to attach a flexible protective member to the fastener in order to protect the adhesive and hooking elements prior to use of the adapted fastener.

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If the adapted fastener strip is to be extensive in length, the tape may be rolled up onto rollers with the flexible member protecting the tape elements so they don't adhere to the substrate of the next roll layer. A sensor or  
5 other indicator means for detecting the flattened area created by the second ultrasound station may be used which then provides for cutting the tape in the flattened area. Again, the tape may have the flexible protective member for shipping.

10

It should be appreciated that these stations may be used in a plurality of different combinations to provide a final tape in a desired form.

15

A further embodiment of this invention comprises a method of adapting a separable fastener member of the hook and loop-type for attachment to an object. The steps comprise taking a separable fastener member having a plurality of hook-type or loop-type engaging elements  
20 upstanding from one surface; and, simultaneously attaching the separable fastener member to a second member positioned in back to back relation with the surface of the fastener member opposite the surface having the engaging elements. The second member has a plurality of elements upstanding from the opposite surface, and the elements are capable of being  
25 surrounded and encapsulated by a material forming at least a part of the object.

Alternatively, the method may use an attaching step  
30 which comprises the steps of applying an adhesive material to the second member, and positioning the separable fastener member against the adhesive material such that upon curing or drying of the adhesive material, the separable fastener member becomes adhesively attached to the second member. In  
35 this case the adhesive may be a hot-melt adhesive. When the

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hot-melt adhesive is used the method may further include subsequently directing the separable fastener member and subsequently directing the separable fastener member and second member through a cooling zone to shorten the setting  
5 time of the hot melt adhesive.

A second alternative is the use of solvent based adhesives in which instance the separable fastener member, and second member may be directed through solvent removing  
10 means, to thereby shorten the setting time of the adhesive disposed therebetween.

In any event the method may also include disposing a metal strip between the separable fastener member and  
15 second member so as to render them magnetically attractive. Once adapted the separable fastener may be attached to a synthetic foam member.

A preferred embodiment of the method of the  
20 invention may is used to produce a foam plastic article with a separable fastener attached thereto by taking a separable fastener member having a plurality of hook-type or loop-type engaging elements upstanding from one surface; attaching the separable fastener member to a second member positioned in  
25 back to back relation with the surface of the fastener member opposite the surface having engaging elements. The second member has a plurality of elements -- preferably in the form of monofilament loops -- upstanding from the opposite surface, which elements are capable of being surrounded and  
30 encapsulated by a material forming at least a part of the article. This is followed by the steps of placing the assembly of the separable fastener member and second member into a trough of a mold unit such that the elements extend into the inner space of the mold; filling the mold with  
35 plastic foam forming components in liquid form; allowing the

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forming components to surround and encapsulate the elements without the elements interfering with the free escape of excess gas from the space surrounding the elements; and, allowing said foam forming materials to cure, dry or set while encapsulating the elements thereby creating a foam plastic article with said separable fastener attached thereto with its upstanding engaging elements extending away from the surface of the article. The article may be modified by positioning a protective cover over the engaging elements to protect them from contamination by the foam forming components. A further step may include heating the foam plastic article thus formed to thereby cure the plastic foam material.

When the heat curing step is used, the protective covering may advantageously be a polyethylene layer which melts and disintegrates when subject to the heat of curing of the foam plastic material.

The further embodiment of the invention also includes an adapted separable fastener for attachment to a foam plastic article. This fastener comprises a separable fastener member of the hook and loop-type; a second member attached to said separable fastener member in back to back relation on the side of said separable fastener member opposite the side having said engaging elements; and a plurality of spaced elements extending from said second member which may be surrounded and encapsulated by plastic forming at least part of said foam plastic article.

The adapted separable fastener of the second member may be woven hook-type separable fastener tape prior to cutting the elements to form hooks, or woven hook-type separable fastener tape.

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The adapted separable fastener may be such that the second member is adhesively attached to the separable fastener. In this case the adhesive is a hot-melt adhesive, or a liquid based adhesive.

5

In some applications the adhesive is a solvent based adhesive. Alternatively, the adhesive is a water based adhesive, or an epoxy resin.

10

The invention also includes the adapted separable fastener for attachment to a foam plastic article comprising a separable fastener member of the hook and loop-type; a second member attached to the separable fastener member in back to back relation on the side of the separable fastener member opposite the side having the engaging elements; and a plurality of elements extending from the second member which are capable of being surrounded and encapsulated by plastic foam forming components while permitting the free escape of gas by-products produced by polymerization of the components thereby permitting attachment of said separable fastener member and said second member to the finished foam article. The plurality of elements may comprise spaced upstanding loop-like elements extending from the surface of the second member opposite the surface attached to said separable fastener member.

25

The monofilament loops of the second member are preferably about one-eighth inch to three-eighths inch in height. In one embodiment the second member and elements are hook-type separable fastener members. Also, a metal strip is preferably disposed between the separable fastener member and the second member so as to render the adapted fastener magnetically attractive for secure positioning within a forming mold supplied with heavy duty magnets in predetermined locations.

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The preferred method for attaching a separable fastener of the further embodiment to a foam plastic object comprises, taking a separable fastener member having a plurality of hook-type or loop type engaging elements upstanding from one surface; positioning a metal strip in back to back relation with the surface of the fastener member opposite the surface having engaging elements; and adapting the separable fastener member for attachment to the foam plastic article by attaching the separable fastener member to a second member positioned in back to back relation with the surface of the fastener member opposite the surface having engaging elements interposing -- or sandwiching -- the metal strip therebetween. The second member has a plurality of elements upstanding from the opposite surface which are capable of being surrounded and encapsulated by a material forming at least part of said object. Further steps include positioning the adapted separable fastener member in a trough of a mold unit which trough has magnetic means to maintain the adapted fastener in position in the trough by magnetic attraction to said metal strip, the adapted fastener being positioned such that the elements extend into the inner space defined by the mold; introducing foam forming components in liquid form into said mold so as to permit the components to flow into and around said plurality of upstanding elements; allowing the foam forming components to surround and encapsulate the elements while undergoing polymerization and permitting free venting of excess gasses formed by the polymerization process.

This method may advantageously include attaching a plastic protective covering to the assembly, prior to placing the assembly in the trough, in a position covering the engaging elements of the separable fastener so as to protect same from contamination by foam forming components.

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The method may further include placing the object in a curing oven after molding in order to cure the foam and melt away the plastic protective covering.

5

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of the apparatus of the invention for practicing the inventive method of adapting a hook and loop-type separable fastener member for attachment to another object.

10

FIG. 2 is a view of the ultrasonic stitching apparatus of one embodiment of the apparatus taken along lines 2-2 of FIG. 1.

15

FIG. 3 is a cross-sectional view of the completed adapted fastener of the invention showing a separable fastener tape of molded plastic construction, a backing, a substrate, and a protective liner.

20

FIG. 4 is a cross-sectional view of the completed adapted fastener of the invention taken along lines 4-4 of FIG. 3.

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FIG. 4A is a partial cross-sectional view of an alternate form of hook-type separable fastener tape of woven construction.

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FIG. 4B is a partial cross-sectional view of the adapted fastener of the invention incorporating an alternate form of hook-type separable fastener tapes having hooking elements having a mushroom configuration.

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FIG. 4C is a partial cross-sectional view of the adapted fastener of the invention incorporating an absorbent substrate backing member.

5           FIG. 5 is a perspective view of an adapted separable fastener and a polyurethane foam forming mold with trough for receiving and holding the adapted fastener during the molding process for molding an automobile seat cushion.

10           FIG. 6 is an enlarged view, partially broken away, of the ultrasonic horn and anvil showing the ultrasonic stitching process of one embodiment of the invention.

15           FIG. 7 is a side elevational view of the second ultrasonic horn of one embodiment of the invention.

20           FIG. 8 shows the adapted separable fastener used to hold automobile upholstery onto a polyurethane seat cushion after the adapted fastener is secured by the molding process to the foam material of the seat cushion.

          FIG. 9 is a cross-sectional view taken along lines 9-9 of FIG. 9 illustrating the attachment interface between the adapted fastener and the seat cushion of FIG. 8.

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#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

          The apparatus used for adapting the separable fastener member is shown overall in Fig. 1 with further details illustrated in Figs. 2 and 6. The apparatus shown in  
30           Fig. 1 is comprised of feeder rolls 10, 12 and 14 which feed the strips of hook tape 16, substrate 18 and metal strip 20 to the attaching unit 22. The attaching unit 22 may take a number of forms but is preferably a continuous ultrasonic  
35           stitching machine. For example, it may also be an adhesive

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applicator in conjunction with pressure rollers and a setting (or curing) station 24. The adhesive may be a hot melt adhesive in which case the setting station would be a refrigeration unit. Alternatively the adhesive may be liquid, either water or solvent based, in which instance the setting station would be a solvent removing means such as an oven. The preferred attaching unit is shown as an ultrasonic stitching device which ultrasonically stitches the members together. This type of unit is comprised of a horn 26 and anvil 28. The hook tape 16 may be molded or woven but is preferably molded for automobile seat cushion applications as will be described below. The molded hook tape is preferably of nylon and the substrate 18 may be of an absorbent material such as a non-woven material but may be of woven construction and preferably of a material which is ultrasonically compatible with the hook tape. In one preferred embodiment the substrate 18 has a plurality of monofilament loop elements 30 upstanding from one surface as shown in Fig. 3.

In the preferred embodiment, the hook tape 16 of the type disclosed in U.S. Patent Nos. 3,708,833 to Ribich et al and 3,762,000 to Menzin et al., molded tape 16 is fed into ultrasonic stitching machine 34 with the hook side 32 facing upward that is, toward the top of Fig. 1. The ultrasonic stitching machine 34 is comprised of two major parts, the horn 26 and the anvil 28 which includes a central sprocket-like portion 36 and two outside stitching lands 38. The outside lands 38 are operative for part of the actual stitching process while the center sprocket 36 acts to feed and center the substrate material. The two outside lands are spaced in such a manner that they ride just inside the edges of the separable fastener tape, that is, the width of their separation is determined by the width of the separable fastener to be adapted.



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The two outside lands 38 have a shape similar to a sprocket, but on a smaller scale than the central sprocket-like portion 36. They each have a series of tooth-like projections 40 spaced approximately  $1/32$  of an inch apart along the circumference of each land. In one embodiment, each projection is approximately  $3/16$  of an inch in length as measured in the direction of the circumference,  $1/8$  of an inch in width and of suitable height sufficient to permit the horn to apply pressure to the tape when the tape is supported on the lands. Each projection supports the members to be attached and has a small groove on its peak surface running in a direction transverse to the length of the tape. One function of this groove is to provide relief for the softened material.

The desired substrate 18 moves toward, and is mated in back-to-back engagement with the separable fastener tape 16 to be adapted. In the preferred embodiment a strip of metal 20 is disposed between the separable fastener tape 16 and the substrate 18. The metal strip 20 adds a magnetically attractive property to the fastener for purpose which will be described below. The separable fastener tape 16 and metal strip 20 are fed onto the substrate 18 by rollers 10, 12 and 14. The separable fastener tape 16, the metal strip 20 and the substrate 18 are held in their relative positions and orientation as they pass between the anvil 28 and the ultrasonic horn 26. The ultrasonic horn 26 is positioned against the hook-tape 16 as indicated in Figs. 1, 2, and 6, that is, the ultrasonic horn 26 moves toward the anvil 28 while applying ultrasonic energy to the components as they pass between the horn and the anvil. The ultrasonic horn is positioned such that as each land rotates to its peak position, the fastener and substrate are squeezed between the anvil and horn and are continuously welded together by the ultrasonic energy provided by the horn when the fastener and

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substrate are supported by the anvil. The center section of the horn has an opening 42 such that the hooking elements of the tape pass through without interference. The motions of the horn 26 and anvil 28 create a continuous series of ultrasonic stitches which appear on the tape as a series of spaced indentations. In one embodiment, each stitch is approximately  $1/32$  of an inch long (as measured in the lengthwise direction of the tape and spaced about  $1/16$  of an inch apart). The tape remains intact between each stitch. Thereafter, the resultant product is comprised of a substrate member ultrasonically stitched to the separable fastener tape with the hooks of the tape facing upward and a metal strip disposed therebetween. The substrate is preferably wider than the separable fastener and this leaves a margin of about  $1/4$  inch of substrate extending beyond the separable fastener on either side.

The structure of substrate member 18 is crucial to one embodiment of the invention to provide gas release and acceptable adhesion without delamination or imperfections in the foam. The substrate member 18 has a plurality of elements 30 upstanding from the surface of a base 44 which is usually of woven construction. The elements are spaced to allow free movement of foam forming components and gases through and around them. In the preferred embodiment, an uncut woven hook-type separable fastener tape is used as the substrate. That is, the usual hook-type tape is produced on a loom. The tape is of the type usually made of a woven nylon base member having monofilament nylon loops extending from one surface which are ultimately cut to form hook-type hooking elements. However, for the present application, when the tape is to be used as a substrate, the loop cutting process is bypassed and the loops remain as loops per se (i.e., uncut hooks). These loops are preferably from approximately  $1/8$  inch to  $1/4$  inch in height and number

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approximately thirty-two in a line traversing a one and three-quarter inch width tape. However, depending upon the actual foam-forming components used, and the degree of attachment which is desired, any size and density  
5 monofilament loops may be used. In fact, depending upon the precise circumstances, it is foreseeable to utilize other types of loops, such as multifilament loops, provided that the actual loop density and the foam forming components and by-products thereof are precisely matched as will be more  
10 accurately described below.

After the separable fastener has been attached to the substrate the adapted fastener can either be rolled up on a spool 46 or cut to desired lengths. Other operations may  
15 be performed on the product between the ultrasonic stitching machine 34 and the take up spool 46 to improve or facilitate end use of the product. In Fig. 1 the product exits the ultrasonic stitching machine (or alternate attaching unit) and enters a second ultrasonic machine 48. This station  
20 differs from the previous ultrasonic station in that it has a flat anvil surface 50 in place of the rotary anvil at the first station. This second station is only used when strips of predetermined length are desired. The second horn 52 has no space to permit the hooking elements to pass without  
25 interference. In operation the tape is measured by measuring means which is usually automatic. When the point on the tape where a cut is to be made has been determined the second horn comes down and ultrasonically flattens a predetermined area of the hooks of the molded tape and at the same time welds  
30 them so as to be combined with the tape surface. This provides a broad weld area where a cut can be made at a cutting station 54, which cut will leave two finished ends. The horn 52 is raised above the hooking elements to allow their passing without interference between points to be  
35 marked.

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The product may also pass under a hot-melt adhesive dispenser 54 which applies adhesive to the margins 56 of the product formed by the substrate extending beyond the width of the fastener. The product and adhesive are passed through a  
5 refrigerated area 58 to cool the hot-melt adhesive partially, before applying a protective polyethylene liner 60 from spool 62 alternatively the liner may be in the form of release paper. The cooling step is necessary for the proper function of the adhesive with the protective liner 60. The liner  
10 protects the hooks and adhesive in packaging (i.e. rolling on a reel) the polyethylene liner is used to prevent the foam forming components from contaminating the active hooking elements during the molding process discussed below.

15 After the adhesive and liner have been applied, the continuous tape is run through a cutting apparatus 64. The cutting apparatus cuts the tape across a point substantially centered in the weld area created by the second ultrasonic  
horn. In this manner the fastener is completely adapted for  
20 use while in continuous form and finally cut to lengths desired leaving finished ends on the product.

Prior to attaching the strip to the final product, if release paper is used as a liner, it is first removed. As  
25 shown in FIG. 5, for attaching the adapted fastener to a polyurethane molded object such as an automobile seat cushion, the adapted fastener is placed in a pre-cut trough 48 with walls 50 that extend into the mold. The fastener is placed with the hooks facing into the trough 48 and the  
30 substrate 16 exposed to the internal area of the mold. The adhesive on the margins of the substrate in one embodiment secures the fastener to the trough by attaching to the surface 52 of the mold walls 50 adjacent the trough. This holds the fastener in place during the molding process.

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Within trough 66 are heavy duty magnets 70. The magnets 70 attract the metal strip 20 towards the bottom of the trough and thus maintain the adapted separable fastener securely in position against the mold during the molding  
5 process.

When the mold is filled with polyurethane foam forming components, the foam forming components are absorbed into the non-woven substrate or, in the preferred embodiment, the foam forming materials actually envelop the elements 30  
10 of substrate 18 while simultaneously undergoing polymerization. The foam forming components expand and fill the recess formed by the walls of the mold 70, and form the seat cushion. Unnecessary gaseous by-products of  
15 polymerization are readily vented past the monofilament loops of the alternate embodiment, thus facilitating unencumbered polymerization and secure envelopment of, and attachment to, the monofilament loops so that the adapted fastener is firmly secured to the seat cushion when it is removed from the mold.  
20 When the forming components finally expand and set, the separable fastener remains securely attached to the seat cushion by virtue of the fact that the foam has been drawn into the intestices of the substrate or, in the alternative embodiment the upstanding loop elements 30 have become  
25 encapsulated by the polymerized foam material. Other synthetic resin foam forming components such as polystyrene or polyvinyl chloride may be used in place of polyurethane foam forming components.

It can be readily appreciated from the foregoing  
30 that alternate forms of substrate material, other than non-wovens or materials having upstanding monofilament loops, may be used. Such material should have upstanding members which are compatible with the foam material used so that attachment  
35 is readily and securely attained. Also in the preferred

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embodiment such substrate must have upstanding members which are dimensioned for attachment and which are particularly spaced to permit venting of gaseous by-products while eliminating problems of skinning and delamination as was sometimes encountered in prior art attempts. In fact, it can be appreciated that it would be possible to utilize a multifilament loop material (i.e., the mating half of hook and loop separable fastener tape) provided that the multifilament loop area density and height are controlled to facilitate compatible attachment to the foam material. Further, so long as the upstanding members are attachable to the foam material, they may take any form or shape such as, for example, monofilament cut hooks, mushroom elements, or even molded upstanding elements. In the latter example, it is foreseeable within the scope of the invention, to attach two molded hook-type fastener loops in back-to-back relation, one side for attachment to the foam member, the other for attachment to another mating surface, such as the napped or fuzzy surface of an automobile seat cover.

As noted, the elements 30 are thus firmly embedded in and encapsulated by the foam. Any foam which is formed from components which may have leaked around the edges of the adapted fastener during the molding process may be brushed away. This is easily accomplished when a polyethylene liner is used, since the polyethylene liner remains intact and since most foam materials will not adhere to polyethylene. The formed object is then directed through a curing oven at about 250°F which causes the polyethylene liner to melt and disintegrate, thereby making the separable fastener ready for use.

The finished automobile foam seat cushion shown in Fig. 8 illustrates the preferred application of the present invention wherein seat cover material 72 has a napped or

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fuzzy backing which readily engages and disengages to the foam cushion to provide a readily attachable cover. As noted, the backing of the material 72 may be a loop-type or natural napped fuzzy backing, or alternatively, corresponding mating loop fastener members may be stitched or otherwise secured to the rear surface of the cover material 72. It will be appreciated that the proper alignment of the seat cover material with respect to the foam cushion is readily obtainable by the multiplicity of attachments and relative positions available through the use of the adapted separable fastener of the invention. Further, it can be appreciated that the adapted separable fastener of the invention can be utilized for a multitude of applications in which attachment can be made to other settable or curable materials, including such materials as adhesives, cement or the like.

By way of further example it is also possible to attach the adapted fastener to any object such as a concrete or cement block wall and to thereafter attach objects such as wall paneling adapted to be separably fastened to the adapted fastener strips.

Fig. 4 illustrates the adapted fastener in which a molded hook-tape is used as the fastener having upstanding hooks or spear-like members molded integrally with the base. Fig. 4A illustrates an alternate form of hook tape namely the woven type nylon or polyester hook tape having upstanding monofilament hooks interwoven first as loops with the base and thereafter cut to form hooks. This form may also be of knitted construction. Fig. 4B illustrates the use of mushroom tape being either of woven or knitted construction and having upstanding mushroom like members which are formed either by heat or other deforming techniques. Fig. 4B illustrates the alternate embodiment of the invention, namely the use of molded hook tape 16 and non-woven absorbent

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substrate 18a formed preferably of polyester fibrous material. Other alternate forms of hook tapes and substrates may be used to practice the invention and such tapes may be formed by a multitude of fabricating techniques. It is  
5 important, however, that the members utilized satisfy the above-noted parameters and that they are ultrasonically compatible with each other and with the foam or other material to which the adapted fastener is to be attached.

10 Although the invention has been described using a small number of embodiments it is to be understood that these are given as illustrations and not intended to limit the scope of the invention in any way. For example loop-type hooking elements may be used in place of hook-type elements,  
15 or a metallic strip interposed between the fastener tape and the liquid absorbent material may be used in conjunction with magnets in a mold in place of the liquid adhesive means. By way of further example it is also possible to attach the adapted fastener to any object such as a concrete or cement  
20 block wall and to thereafter attach objects such as wall paneling adapted to be separably fastened to the adapted fastener strips.

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CLAIMS

1. A separable fastener assembly of hook- or loop-type which comprises, a separable fastener member having a  
5 plurality of hook- type or loop-type engaging elements upstanding from one surface, and a substrate member positioned in engagement with the surface opposite said engaging elements and attached to said fastener member.

10 2. The separable fastener assembly to claim 1, further comprising a metallic strip interposed between said fastener member and said substrate member, and a thin film covering the surface of said separable fastener member and attached to both sides thereof on said absorbent material.

15 3. The separable fastener assembly according to claim 2 wherein said separable fastener member is a plastic molded hook-type fastener member.

20 4. The separable fastener assembly according to claim 3 wherein said substrate member is attached to said separable fastener member by continuous ultrasonic stitching.

25 5. The separable fastener assembly according to claim 4 wherein said substrate member is a base member having a plurality of monofilament loop type elements upstanding from the surface opposite the surface to which said separable fastener member is attached, said monofilament loop-type elements being capable of becoming encapsulated by foam  
30 material formed from liquid foam-forming components.

6. The separable fastener assembly according to claim 4 wherein said substrate member is a liquid absorbent material.

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7. An apparatus for adapting a separable fastener member of the type having a plurality of hook- and loop-type hooking elements upstanding from one surface comprising,

- 5           a) means for movably supporting a substrate member,
- b) means for movably supporting and positioning said separable fastener member, such that the side opposite the side having the plurality of hooking elements is in continuous face to face  
10           contact with said substrate member,
- c) means for movably supporting and positioning a metallic strip, such that the metallic strip is interposed between said substrate member and said separable fastener member, and  
15           d) means for continuously ultrasonically attaching said substrate member and said separable fastener member interposing said metallic strip therebetween.

20           8. The apparatus according to claim 7 further comprising:

- a) means for movably supporting and positioning a thin film strip, such that the side of hooking  
25           elements of said fastener member is in continuous face to face contact with said thin film, and
- b) means for continuously attaching said thin file strip to at least one of said fastener  
30           member and said substrate member.

9. The apparatus according to claim 7 wherein said substrate member is a base member having a plurality of upstanding monofilament loop-type elements capable of becoming

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encapsulated by foam-material formed from liquid foam-forming components.

10. The apparatus according to claim 7 wherein said  
5 substrate member is a liquid absorbent material capable of absorbing liquid foam-forming components prior to formation of the foam.

11. The apparatus according to claim 7 further  
10 comprising means for marking, means for ultrasonically fastening and means for cutting the fastener assembly in predetermined discrete lengths.

12. A method for making a foam object attached by at  
15 least a separable fastener assembly which comprises,  
a) taking at least a separable fastener assembly comprising a separable fastener member of the type having hook-type or loop-type hooking elements upstanding from one surface, a  
20 substrate member positioned in engagement with the surface opposite said hooking elements and attached to said fastener member, and a metallic strip interposed between said fastener member and said substrate member,  
25 b) placing and fixing said separable fastener members in a mold for the foam object such that said substrate member faces toward the inner volume of the mold and said fastener members are placed on magnets installed in the mold to attract the fastener strip,  
30 c) introducing liquid foam forming components into said mold, and  
d) allowing said foam forming components to surround the absorbent material and become set

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and thereby said fastener member attaches securely to a resultant foam object.

5        13. The method according to claim 12, further comprising a thin film covering the surface of said separable fastener member.

10       14. A covered article with fabric covering which comprises an object of synthetic foam,

15       a) at least a separable fastener assembly of the hook-type comprising a fastener member, at least one layer of substrate material attached to said fastener member and a metallic strip interposed between said fastener member and said substrate material, such that said separable fastener is attached securely to said foam object with the surface of said substrate material, wherein said fastener assembly is positioned and fixed on magnets installed in the mold for the foam object by the magnetic force between said metallic strip and said magnets and thereafter foaming components are introduced into the mold, allowed to surround at least portions of the substrate material and become set, and

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30       b) a fabric cover means attached to said synthetic foam object by means of a backside of the fabric cover means and a surface having a plurality of hook-type engaging elements of said fastener member, after removing the thin film from the surface of the fastener assembly, attached to said synthetic foam object.

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15. The covered article according to claim 14 wherein  
said substrate material is a base member having a plurality  
of upstanding monofilament loop-like elements capable of  
5 becoming encapsulated by foam material formed from liquid  
foam-forming components.

16. The covered article according to claim 14 wherein  
said substrate material is a liquid absorbent material.

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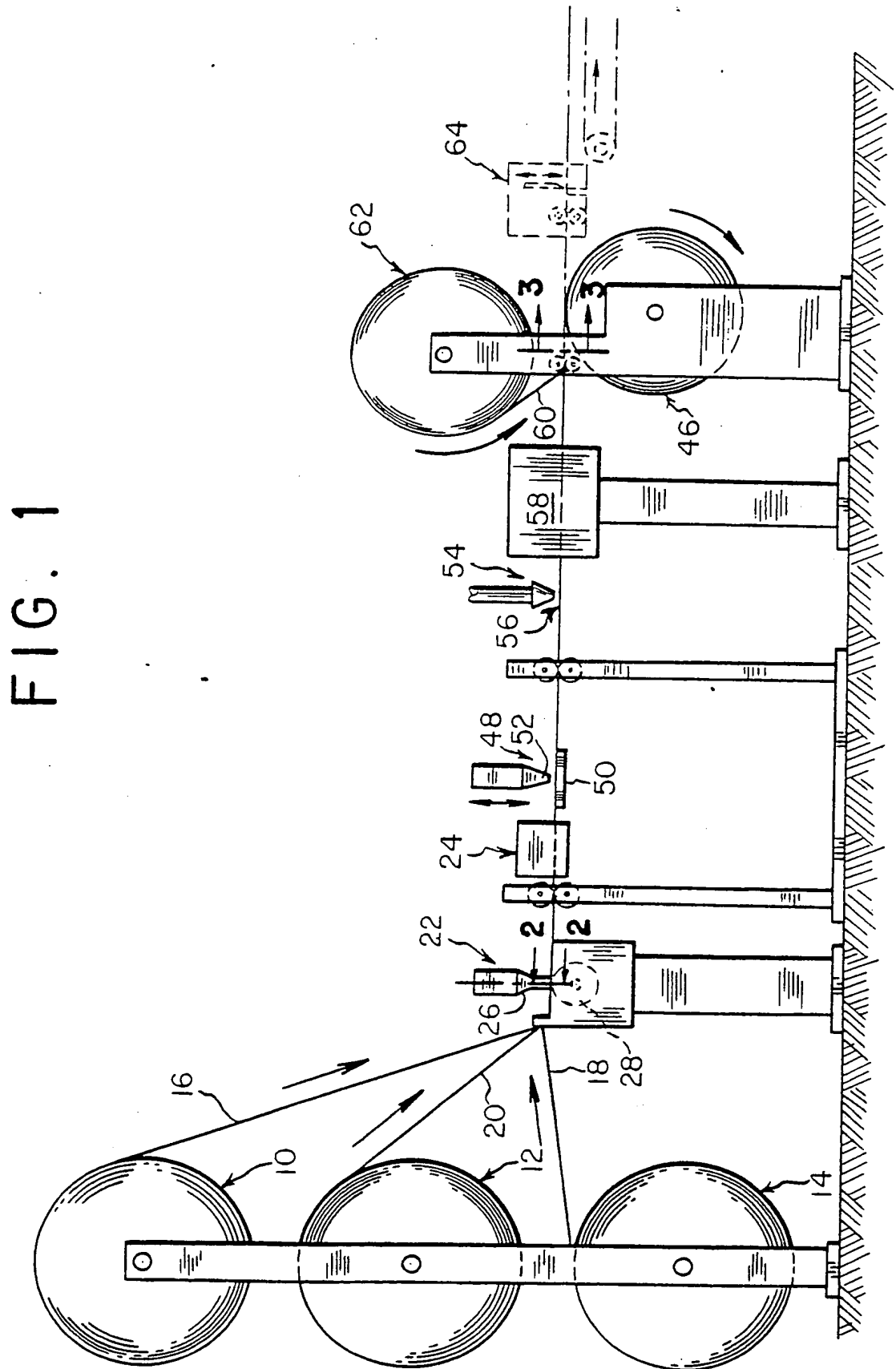
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**SUBSTITUTE SHEET**

**FIG. 2**

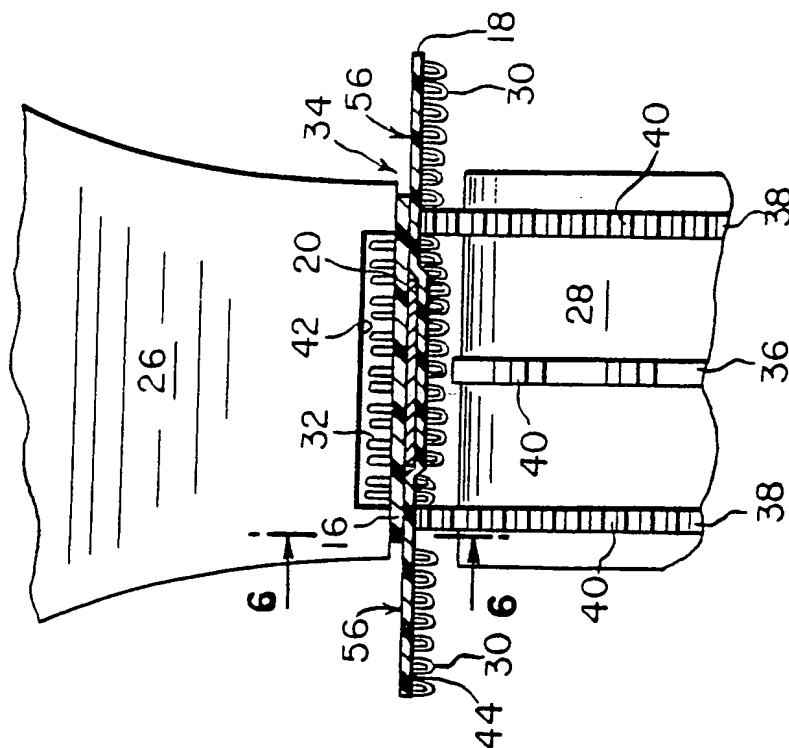


FIG. 3

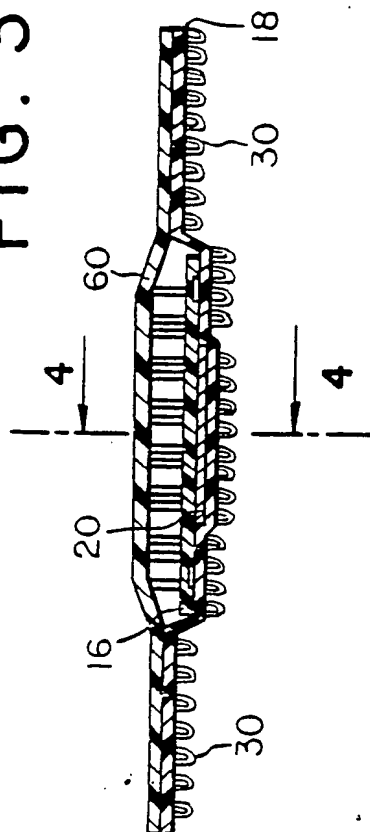


FIG. 4.

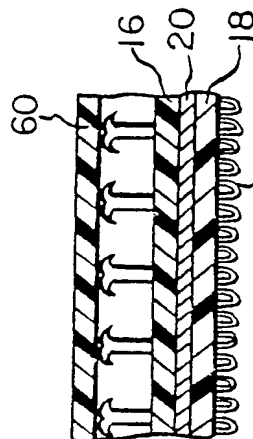


FIG. 4A



FIG. 4B

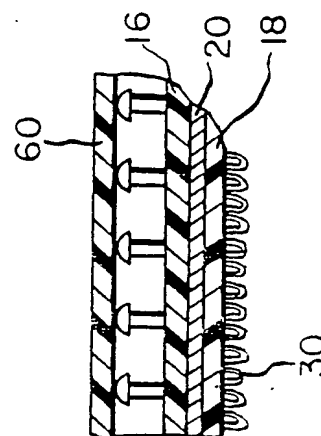
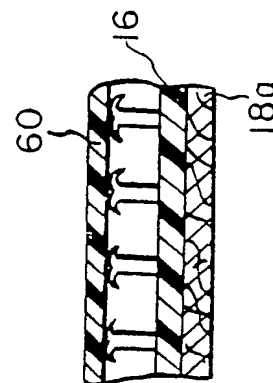


FIG. 4C



6. FIG.

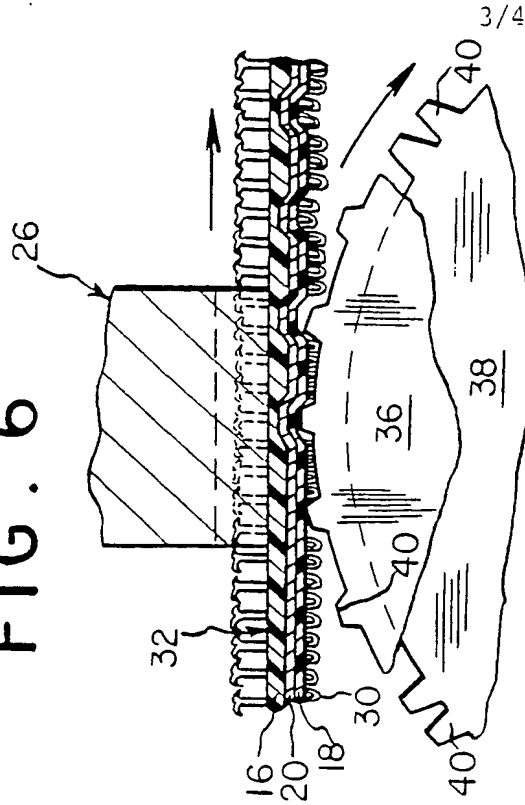
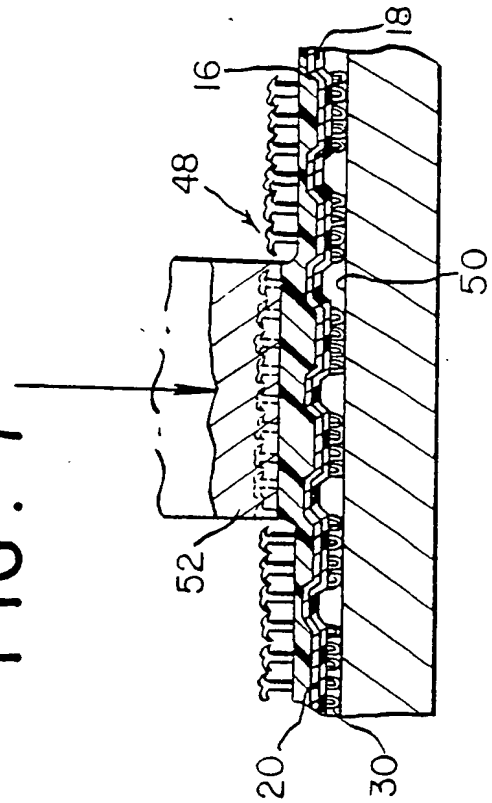
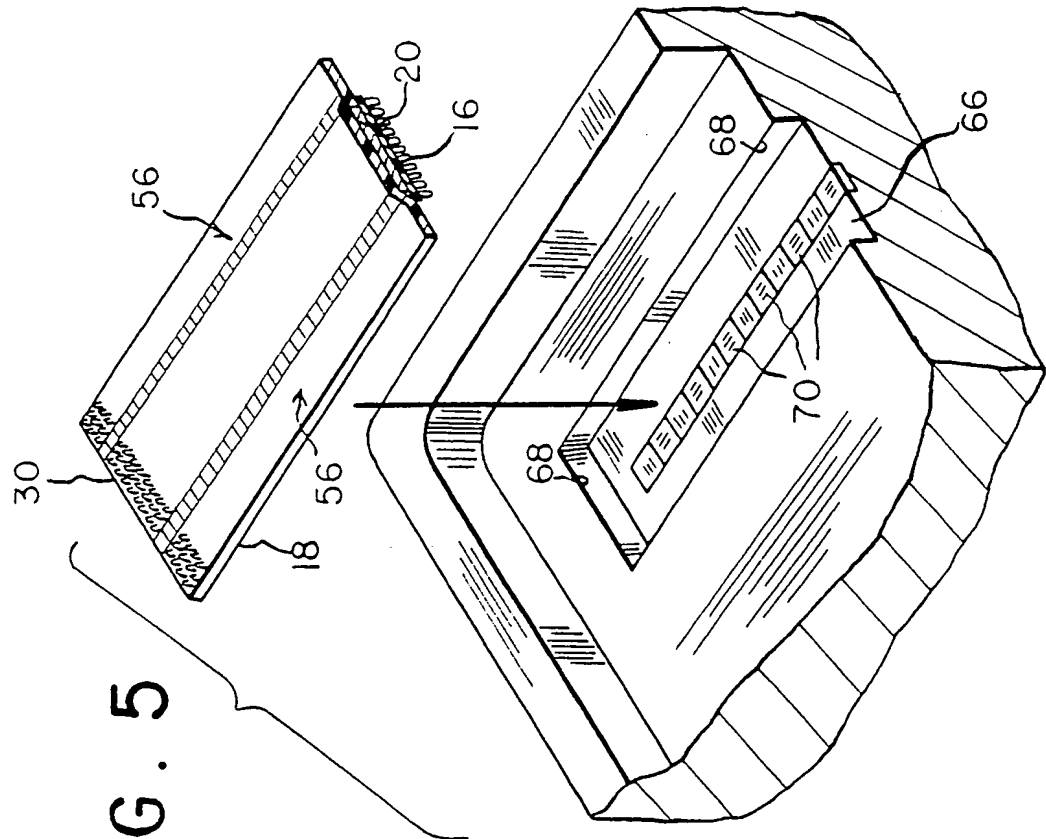


FIG. 7



5.6.1





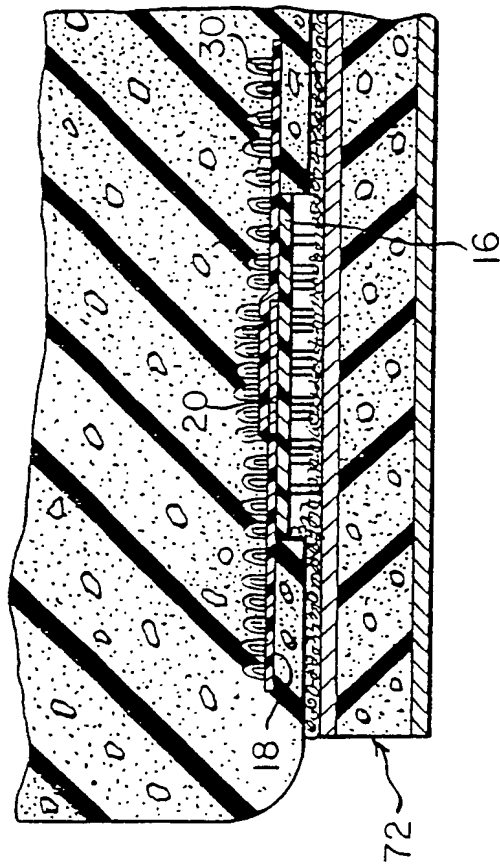
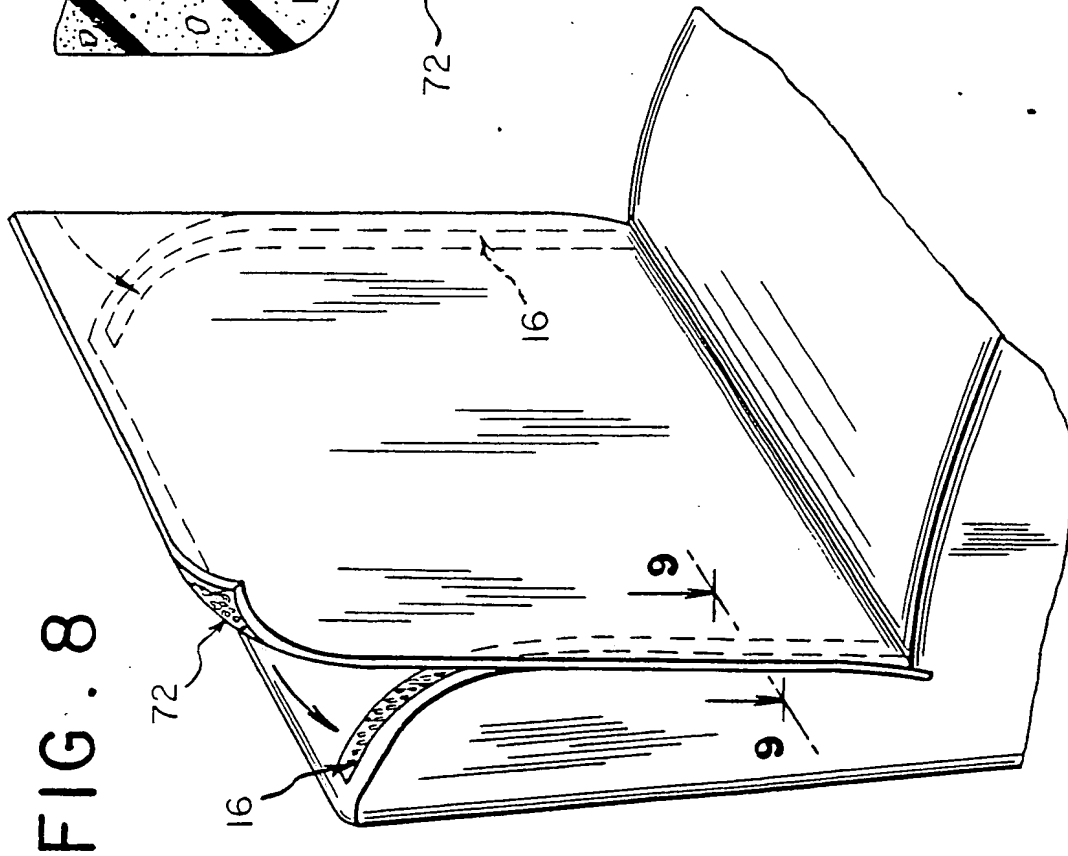
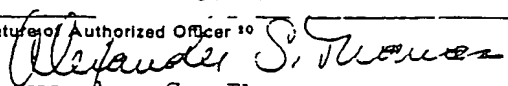


FIG. 9

FIG. 8

# INTERNATIONAL SEARCH REPORT

International Application No. **PCT/US85/02290**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>3</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC <b>IPC B32B 3/06, B29C 67/00</b> <b>U.S. CL. 428/100; 156/580; 264/46.4, 46.7</b>		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
Classification System	Classification Symbols	
U.S.	428/100, 156/580.1; 264/46.4, 46.7	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category <sup>*</sup>	Citation of Document, <sup>15</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
X	US, A, 4,470,857 PUBLISHED 11 SEPTEMBER 1984 CASALOU	1-16
E	FR, A, 2,556,271 PUBLISHED 14 JUNE 1985	1-16
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>*</sup> Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Δ" document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search <sup>1</sup>	Date of Mailing of this International Search Report <sup>1</sup>	
17 DECEMBER 1985	10 JAN 1986	
International Searching Authority <sup>1</sup>	Signature of Authorized Officer <sup>10</sup>	
ISA/US	 Alexander S. Thomas	